

Firm Productivity and Exports in the Wholesale Sector: Evidence from Japan

Ayumu Tanaka[†]

Abstract

Recent works show that wholesale exporters play a large role in international trade. Wholesalers provide intermediate services for manufactures and account for a substantial portion of total export values for Italy, Japan, and the US. This study tries to provide the first evidence on the link between firm productivity and exports by wholesalers, using Japanese firm-level data. Empirical analysis reveals that wholesale firms are heterogeneous and that exporters are more productive than non-exporters in the wholesale sector, as in manufacturing sector. In addition, the analysis provides the evidence that exporters with foreign subsidiaries tend to be more productive than exporters without foreign subsidiary and that exporters with foreign subsidiaries outperform exporters without foreign subsidiary in terms of other measures such as average exports, export-sales ratio, and the extensive margin of exports. These results are in line with the firm heterogeneity model of exports and are similar with the previous empirical studies on manufacturing.

Keywords: wholesale; firm heterogeneity; export

JEL Classification: F10, F14, L81

[†] College of Economics, Aoyama Gakuin University and Research Institute of Economy, Trade and Industry (RIETI)

E-mail: tanaka-ayumu<at>rieti.go.jp, Tel: +81-3-3501-8577

Address: 4-4-25 Shibuya, Shibuya-ku, Tokyo 150-8366, Japan

1 Introduction

In 1985, Japan's top nine general trading companies (GTCs), known as "Sogo Shosa," accounted for 45 percent of Japan's total exports (Rauch 1996). These giant GTCs are multinational enterprises (MNEs), have a large number of foreign subsidiaries, and continue to play an undoubtedly significant role in Japanese trade.¹⁾

As the above example of Japanese GTCs and as Bernard et al. (2011) show, a small number of large wholesalers account for a large portion of international trade, suggesting large heterogeneity within wholesalers. In addition, the regression results of Bernard et al. (2011) reveal that on average, wholesale exporters have total sales 13.4 times larger than non-exporters and employ 2.7 times as many workers. They also reveal that labor productivity, that is, sales per employee, at exporting intermediaries is 4.8 times higher than at non-exporters. This evidence suggests that wholesalers are heterogeneous in terms of their productivity and that most-productive wholesalers self-select into the export market, while less-productive wholesalers serve only the domestic market.

However, to the best of my knowledge, no study examines the link between firm productivity and export status in the wholesale sector, using the non-parametric Kolmogorov-Smirnov (KS) test. The KS test is a stricter test of productivity differences than just a comparison of the mean levels of productivity, since it considers all moments of the distribution. This study employs the KS tests and examines the relationship between firm productivity and wholesalers' export status, using comprehensive Japanese firm-level data. I show using the KS test that the productivity distribution of exporters stochastically dominates the productivity distribution of non-exporters in the wholesale sector, as in the manufacturing sector.

This study also investigates the relationship between firm productivity and multinational status within exporters. For pure wholesalers, FDI and exports can be regarded as complements rather than substitutes. Japanese GTCs have foreign subsidiaries all over the world, and their local information and activities

1) It is difficult to obtain their share of exports at present due to the lack of publicly available data.

might facilitate exports from Japan by reducing variable trade costs. Due to the fixed costs for FDI, we predict that most-productive exporters can become exporters with foreign subsidiaries by conducting FDI and that less-productive exporters remain exporters without foreign subsidiary. The results from the KS tests indicate that the productivity distribution of exporters with foreign subsidiaries stochastically dominates the productivity distribution of exporters without foreign subsidiary.

This paper contributes to the literature by providing the first comprehensive evidence for wholesalers on the link between firm productivity and exports, in line with the firm heterogeneity model of exports by Melitz (2001). The rest of the paper is organized as follows. In Section 2, the theoretical underpinnings of the following statistical tests are elucidated. Section 3 contains a description of data used in this study and provides an overview of exports by firms in the wholesale sector. Section 4 explains the methodology, and Section 5 presents the results. Finally, Section 6 concludes.

2 Theoretical background

The standard firm heterogeneity model of exports by Melitz (2003) predicts that more-productive firms can export, while less-productive firms cannot export but serve only the domestic market since the latter cannot afford the fixed costs for exporting. In addition, Helpman et al. (2004) extend Melitz (2003) by incorporating foreign direct investment (FDI). In the model of Helpman et al. (2004), firms can export their products to foreign customers or serve them through foreign subsidiaries by engaging in FDI. Helpman et al. (2004) predict that firms conducting FDI, that is, MNEs, are more productive than exporters and exporters are more productive than purely domestic firms, since fixed costs for FDI are assumed to be higher than those for exporting. Numerous empirical studies, including Head and Ries (2003), Girma (2005a, b), and Arnold and Hussinger (2010), have confirmed these theoretical predictions using firm or plant-level data.

Recently, Akerman (2010) and Ahn et al. (2010) extend Melitz (2003) by introducing wholesalers. In their model, wholesalers are assumed to be able to export at lower country-specific fixed costs per product since they can export more than one product and exploit economies of scope in exports. Thus,

wholesalers can export products produced by manufacturing firms who are not productive enough to directly export. Akerman (2010) and Ahn et al. (2010) predict that most-productive firms export on their own by paying fixed costs, but a range of firms with intermediate productivity levels export through wholesalers. Akerman (2010), Ahn et al. (2010), and Bernard et al. (2011) confirm the theoretical prediction that intermediaries are typically providing solutions to country-specific fixed costs.

Although the above theoretical models of wholesalers' exports assume homogeneous wholesalers for simplicity, empirical studies suggest that wholesalers are heterogeneous. Bernard et al. (2011) reveal that on average, Italian wholesale exporters are larger and more productive than non-exporters. Bernard et al. (2011) also find that wholesalers' exports are concentrated among large exporters. They reveal that the top 5 percent of wholesale exporters account for 73.3 percent of Italian wholesaler exports. Similarly, Muûls and Pisu (2009) find that Belgian wholesale and retail exports are concentrated among large exporters. The Gini coefficient for the 2004 Belgian exports in the wholesale and retail sectors reaches 0.974.

Inspired by these empirical findings, this study examines the link between firm productivity and export status in the wholesale sector. First, this study tests the prediction of Melitz (2001) that exporters are more productive than non-exporters. To the best of my knowledge, this theoretical prediction has been tested by many empirical studies for manufacturing firms, but not for wholesale firms, with the only exception being Bernard et al. (2011). We, however, can consider the same mechanism for wholesalers as that for manufacturers: firms whose productivity is above a certain cutoff point will find it profitable to pay the fixed costs of exporting and start exporting. As a result, most-productive wholesale firms self-select into the export markets, while less-productive wholesale firms serve only the domestic market only.

In addition, I explore the role of MNEs in wholesalers' exports.²⁾ I divided

2) In this respect, this study relates to the previous studies that investigate the relationship between exports and FDI for manufacturing firms. Head and Ries (2001) pointed out the possibility that exports and FDI are complements rather than substitutes. They found the positive effect of FDI on exports in listed Japanese manufacturing firms. Kiyota and Urata (2008) also find that MNEs accounted for 93.6 and 81.2 percent of Japanese exports and

exporters into non-MNE exporters, exporters with foreign subsidiaries, and MNE exporters, exporters without foreign subsidiary, in the empirical analysis. As shown in the next section, exporters with foreign subsidiaries dominate wholesale exports. From this fact, I assume that foreign subsidiaries facilitate exports from their parent firms by reducing variable trade costs, although establishing foreign subsidiaries through FDI incurs fixed costs.³⁾ There might be several reasons for MNE exporters' lower variable trade costs. For example, foreign subsidiaries can provide their parent firms with information on the local market and reduce search/matching frictions. Due to the fixed costs of FDI, most-productive exporters can have foreign subsidiaries but less-productive exporters cannot have foreign subsidiaries.

To summarize, I predict that exporters are more productive than nonexporters, as in Melitz (2003). I also predict that exporters with foreign subsidiaries are more productive than exporters without foreign subsidiary because I assume that foreign subsidiaries facilitate their parent firms' exports by reducing variable trade costs, although FDI incurs fixed costs. From both predictions, I predict that exporters with foreign subsidiaries are the most productive and exporters without foreign subsidiary are more productive than non-exporters. This prediction on productivity ranking is tested using Japanese data.

3 Data and overview

3.1 Data

This study uses firm-level data from a mandatory enterprise survey, the Basic Survey of Japanese Business Structure and Activities. The survey is conducted by the Japanese Ministry of Economy, Trade, and Industry (METI). The survey provides the most comprehensive data for the study of wholesalers' exports

imports, respectively. Kiyota and Urata (2008) show that MNEs emerged from being exporters/importers, and are engaged in exports and FDI simultaneously. Kiyota and Urata (2008) insist that exporters decide whether or not to become an MNE by undertaking FDI, while Helpman et al. (2004) and other studies assume that firms choose either to export or to become an MNE. In the case of pure wholesalers, exports and FDI are considered to be complementary since by definition, pure wholesalers do not produce products by themselves in both home and foreign countries.

3) Bernard and Jensen (2004) find in the US manufacturing sector that MNEs are more likely to export.

among currently available data in Japan and is used by many previous studies such as Kimura and Kiyota (2006), although the targets of the METI survey are firms with more than 50 employees and more than 30 million yen in capital.

For the purpose of productivity comparison, I calculate Japanese parent firms' TFP from an estimated two-digit industry-specific production function, using the Levinsohn and Petrin (2003) techniques.⁴⁾ As inputs, I use Japanese parent firms' real value added as the output and hours worked (L) and fixed tangible assets (K). All nominal values are deflated by an industry-level deflator, which is taken from the System of National Account Statistics. Following Arnold and Hussinger (2010), I use relative TFP to compare the TFP for various industries. Relative TFP is obtained by dividing the TFP estimates by the average TFP in the respective industry and year.

3.2 Exporting by firms in wholesale

Before formally analyzing the relationship between firm productivity and exports, this section provides the descriptive statistics on exports by firms in the wholesale sector, comparing them with firms in the manufacturing sector. Table 1 presents the number of exporters, total exports, average exports per firm, and each sector's share of exports in total exports. Table 1 indicates that around 23% of the exporters belong to the wholesale sector and they account for over 22% of the exports in our data.

Table 2 reports the share of exports in our data generated by different size classes in terms of export value, following Bernard et al. (2011). I report the results for the manufacturing, wholesale, and pure wholesale sectors. The pure wholesale sector excludes firms with employees in their manufacturing divisions⁵⁾. Table 2 reveals that exports are extremely concentrated among large exporters. The largest one and five percent of manufacturing exporters account for 61.3 and 85.3 percent of total exports by Japanese manufacturing firms in our data, respectively. Similarly, the largest one and five percent of wholesale exporters account for 64.5 and 84.5 percent of total exports by Japanese

4) I use transportation and package costs to proxy unobserved productivity shocks since my data does not contain costs for electricity or materials or fuels.

5) As Bernard et al. (2011) show, there are wholesale firms that engage in both wholesaling and manufacturing.

Table 1: Exports by sector in the METI survey (2008)

Sector	N. of exporters	Total exports (1 million Yen)	Average exports per firm (1 million Yen)	Share
Manufacturing	4,358	52,900,000	12,133	0.748
Wholesale	1,412	16,200,000	11,452	0.229
Retail	103	99,391	965	0.001
Services	215	1,345,210	6,257	0.019
Other services	54	161,564	2,992	0.002
Total	6,142	70,700,000	11,503	1.000

Table 2: Concentration of exports (2008)

	Manufacturing	Wholesale	Pure Wholesale
Top 1%	61.3	64.5	64.8
Top 5%	85.3	84.5	86.0
Top 10%	92.0	90.7	91.7
Top 25%	97.5	97.2	97.6
Top 50%	99.5	99.5	99.6
Top 100%	100.0	100.0	100.0

Notes: “Pure Wholesale” excludes firms with employees in their manufacturing divisions.

wholesale firms in our data, respectively. The overall tendency of concentration of exports among top wholesale exporters is almost similar with that in manufacturing⁶⁾. However, Table 2 reveals that wholesale exporters are more concentrated among the top one percent direct manufacturing exporters. This finding is different from the finding for Italian exports in Bernard et al. (2011) and can be explained by the existence of giant Japanese GTCs.

3.3 exporters with foreign subsidiaries vs. exporters without foreign subsidiary

Next, I compare the two types of exporters: exporters without foreign subsidiary and exporters with foreign subsidiaries. Tables 3 and 4 display the total exports, average exports per firm, and the export-sales ratio by firm type, in the wholesale and manufacturing sectors, respectively. Tables 3 and 4 reveal that exporters with foreign subsidiaries account for a substantial portion of exports: 88.7% of exports in the wholesale sector and 95.2% of exports in the manufacturing

6) This finding is different from the findings for Italian exports since Bernard et al. (2011) find that wholesale exporters are less concentrated among large firms than are direct manufacturing exporters.

Table 3: Exports by firms in the wholesale sector (Japan, 2008)

	Total Exports (1 million Yen)	Average Exports (1 million Yen)	Export-Sales Ratio
Exporters without foreign subsidiary	1,685,111.0 (0.113)	2,875.6 [24334.485]	0.066 [0.144]
Exporters with foreign subsidiaries	13,218,544.0 (0.887)	23,903.3 [147388.222]	0.117 [0.158]
Total	14,903,655.0 (1.000)	13,084.9 [104652.213]	0.091 [0.153]

Notes: The share of each firm type in all types is shown in parentheses. Standard deviations are shown in square parentheses.

Table 4: Exports by firms in the manufacturing sector (Japan, 2008)

	Total Exports (1 million Yen)	Average Exports (1 million Yen)	Export-Sales Ratio
Exporters without foreign subsidiary	2,556,666.0 (0.048)	1,330.2 [7174.836]	0.105 [0.162]
Exporters with foreign subsidiaries	50,318,539.0 (0.952)	20,656.2 [158884.289]	0.170 [0.198]
Total	52,875,205.0 (1.000)	12,132.9 [119260.421]	0.142 [0.186]

Notes: The share of each firm type in all types is shown in parentheses. Standard deviations are shown in square parentheses.

sector. MNE exporters' average exports and export-sales ratios are much higher than those of non-MNE exporters. These facts indicate that exporters with foreign subsidiaries play a central role in international trade.

Table 5 presents the number of firms and TFP by export status and sector. In order to reveal the pure wholesalers' exports, Table 5 displays the results for the pure wholesale sector and the overall wholesale and manufacturing sectors. Table 5 shows that on average, exporters with foreign subsidiaries are the most productive and exporters without foreign subsidiary are more productive than non-exporters regardless of sector. This productivity ranking is consistent with theoretical conjecture.

Finally, I examine the extensive margin of exports by firm type. Table 6 shows the number of export destinations and the number of exporting industries by multinational status in the wholesale and manufacturing sectors. Table 6 reveals that both the number of export destinations and the number of exporting

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Table 5: Firm productivity and exports status (Japan, 2008)

	Wholesale		Pure wholesale		Manufacturing	
	N. of firms	TFP	N. of firms	TFP	N. of firms	TFP
Non-exporters	4,316 (0.753)	0.809 [1.918]	3,753 (0.767)	0.811 [1.963]	9,266 (0.680)	0.630 [3.067]
Exporters without foreign subsidiary	715 (0.125)	1.057 [3.003]	586 (0.120)	0.863 [1.461]	1,922 (0.141)	0.604 [1.244]
Exporters with foreign subsidiaries	697 (0.122)	2.125 [4.705]	553 (0.113)	2.037 [4.840]	2,436 (0.179)	2.731 [9.021]
Total	5,728 (1.000)	1.000 [2.602]	4,892 (1.000)	0.956 [2.451]	13,624 (1.000)	1.000 [4.663]

Notes: The share of each firm type in all types is shown in parentheses. Standard deviations are shown in square parentheses. Pure wholesale excludes firms with employees in the manufacturing divisions.

Table 6: Extensive margin of exports

	Pure wholesale		Manufacturing	
	N. of export destinations	N. of industries exported	N. of export destinations	N. of industries exported
Exporters without foreign subsidiary	1.677 [1.218]	1.059 [0.269]	1.674 [1.211]	1.055 [0.253]
Exporters with foreign subsidiaries	2.293 [1.605]	1.136 [0.409]	2.296 [1.591]	1.131 [0.447]
Total	1.979 [1.454]	1.101 [0.354]	1.984 [1.447]	1.091 [0.342]

Notes: Standard deviations are shown in square parentheses. The results for the number of export destinations are for the year 2008. The results for the number of industries exported are for the year 2005 due to data limitations.

industries for exporters with foreign subsidiaries are more than those for exporters without foreign subsidiary in both sectors.

In sum, the descriptive statistics are in line with the theoretical predictions that exporters with foreign subsidiaries are the most productive and the exporters without foreign subsidiary are more productive than nonexporters. The ranking of average TFP is fully consistent with the predictions. In addition, exporters with foreign subsidiaries outperform exporters without foreign subsidiary in terms of average exports per firm, export-sales ratio, and the extensive margin of exports.

4 Empirical strategy

This section explains the empirical methodology. To examine the relationship between firm productivity and export status, this study employs the nonparametric one-sided and two-sided KS tests.⁷⁾ These tests allow us to compare and rank the productivity distributions, based on the concept of first-order stochastic dominance.

Let $F_1(\varphi)$ and $F_2(\varphi)$ denote two cumulative distribution functions (CDF) of productivity, φ , for the two comparison groups. The first-order stochastic dominance of $F_1(\varphi)$ relative to $F_2(\varphi)$ is defined as $F_1(\varphi) - F_2(\varphi) \leq 0$ uniformly in $\varphi \in \mathbb{R}$, with strict inequality for some φ . Graphically, this implies that $F_1(\varphi)$ lies entirely to the right (higher-productivity side) of $F_2(\varphi)$.

First, using the two-sided KS statistic, I test the hypothesis that both distributions, $F_1(\varphi)$ and $F_2(\varphi)$, are identical. The null and alternative hypotheses can be expressed as

$$\begin{aligned} H_0 : F_1(\varphi) - F_2(\varphi) &= 0 \text{ for all } \varphi \in \mathbb{R} \\ \text{vs. } H_1 : F_1(\varphi) - F_2(\varphi) &\neq 0 \text{ for some } \varphi \in \mathbb{R}. \end{aligned} \quad (1)$$

Second, the one-sided KS test examines whether a distribution dominates the other. The hypotheses are as follows:

$$\begin{aligned} H_0 : F_1(\varphi) - F_2(\varphi) &\leq 0 \text{ for all } \varphi \in \mathbb{R} \\ \text{vs. } H_1 : F_1(\varphi) - F_2(\varphi) &> 0 \text{ for some } \varphi \in \mathbb{R}. \end{aligned} \quad (2)$$

When the null hypothesis for the two-sided test is rejected and the null hypothesis for the one-sided test is not rejected, it indicates that $F_1(\varphi)$ stochastically dominates $F_2(\varphi)$.

Following Delgado et al. (2002), I test the hypothesis separately for each year from 2001 to 2008, since the independence assumption is likely to be violated if I use pooled observations from several years for the KS test.

7) Previous studies such as Girma et al. (2005) and Arnold and Hussinger (2010) examine the prediction of Helpman et al. (2004) and find that FDI firms are more productive than purely domestic firms and exporting firms, and that exporting firms are more productive than purely domestic firms in the manufacturing industries. This study is the first attempt to empirically examine the link between firm productivity and exports by firms in the wholesale sector using the KS tests.

5 Results

This section presents the results for pure wholesalers.⁸⁾ First, I graphically examine the link between firm productivity and export status. Figure 1 displays the CDF of relative TFP by each firm type in the pure wholesale sector for the year 2008. The TFP distribution of exporters with foreign subsidiaries lies entirely to the right (higher-productivity) side of that of exporters without foreign subsidiary and the TFP distribution of exporters without foreign subsidiary, in turn, lies entirely to the right (higher-productivity) side of that of non-exporters. These support the theoretical prediction of productivity ranking.

Next, I formally examine the productivity ranking using the KS tests. Tables 7 and 8 show the results of KS tests with the number of each firm type. First, Table 7 compares non-exporters with exporters without foreign subsidiary. Column 3 of Table 7 presents the results of the two-sided KS test for the equality of the distributions between non-exporters and exporters without foreign subsidiary. Asymptotic p-values are almost zero for all years, and I can reject the null hypothesis, that is, the equality of the distributions. Column 4 of Table

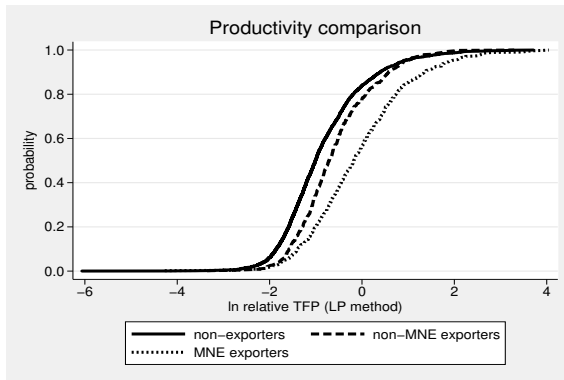


Figure 1: Export status and CDF of productivity in the pure wholesale sector (2008)

Note: The figure presents cumulative distribution functions (CDFs) of non-exporters, exporters without foreign subsidiary (non-MNE exporters), and exporters with foreign subsidiaries (MNE exporters).

8) I only present the results for the pure wholesale sector but the results for the manufacturing and wholesale sectors are qualitatively similar to the results for the pure wholesale sector. The results for the manufacturing sector are presented in the Appendix. To investigate why we obtain similar results, more rigorous theoretical research might be required.

Table 7: Kolmogorov-Smirnov tests statistics for the pure wholesale sector:
Non-exporters vs. Exporters without foreign subsidiary

Year	N. of firms		Statistics	
	D	X	Two-sided H_0 : equality	One-sided H_0 : $D < X$
2001	3831	552	0.164	-0.004
	(79.3)	(11.4)	[0.000]	[0.981]
2002	3606	561	0.156	-0.011
	(78.0)	(12.1)	[0.000]	[0.894]
2003	3466	521	0.156	-0.012
	(78.4)	(11.8)	[0.000]	[0.872]
2004	3500	540	0.182	-0.011
	(77.0)	(11.9)	[0.000]	[0.900]
2005	3407	529	0.175	-0.012
	(76.9)	(11.9)	[0.000]	[0.872]
2006	3656	605	0.179	-0.002
	(76.3)	(12.6)	[0.000]	[0.995]
2007	3778	599	0.194	-0.009
	(76.7)	(12.2)	[0.000]	[0.918]
2008	3753	586	0.175	-0.010
	(76.7)	(12.0)	[0.000]	[0.899]

Notes: Kolmogorov-Smirnov tests for non-exporters (D) vs. exporters without foreign subsidiary (X). The share of each firm type in all types is shown in parentheses. Asymptotic p-values are shown in square parentheses.

7 presents the results of the one-sided test. The null hypothesis is that the productivity distribution of exporters without foreign subsidiary stochastically dominates the productivity distribution of non-exporters. I cannot reject the null hypothesis at any reasonable significance level for all years. From both the two- and one-sided KS tests, I can conclude that exporters without foreign subsidiary stochastically dominate non-exporters, as predicted in theory.

Second, Table 8 compares exporters without foreign subsidiary with exporters with foreign subsidiaries. The results for the two- and one-sided tests are shown in columns 3 and 4 of Table 8. I can reject the null hypothesis for the equality of distributions between exporters without foreign subsidiary and exporters with foreign subsidiaries for all years, while I cannot reject the null hypothesis that the productivity distribution of exporters with foreign subsidiaries stochastically dominates that of exporters without foreign subsidiary. Both results indicate that exporters with foreign subsidiaries outperform exporters

Table 8: Kolmogorov-Smirnov tests statistics for the pure wholesale sector:
Exporters without foreign subsidiary vs. Exporters with foreign subsidiaries

Year	N. of firms		Statistics	
	X	M	Two-sided H_0 : equality	One-sided H_0 : $X < M$
2001	552	448	0.302	0.000
	(11.4)	(09.3)	[0.000]	[1.000]
2002	561	459	0.284	-0.002
	(12.1)	(09.9)	[0.000]	[0.998]
2003	521	436	0.306	0.000
	(11.8)	(09.9)	[0.000]	[1.000]
2004	540	507	0.307	0.000
	(11.9)	(11.2)	[0.000]	[1.000]
2005	529	494	0.280	0.000
	(11.9)	(11.2)	[0.000]	[1.000]
2006	605	530	0.261	-0.004
	(12.6)	(11.1)	[0.000]	[0.991]
2007	599	551	0.266	0.000
	(12.2)	(11.2)	[0.000]	[1.000]
2008	586	553	0.248	-0.002
	(12.0)	(11.3)	[0.000]	[0.997]

Notes: Kolmogorov-Smirnov tests for exporters without foreign subsidiary (X) vs. exporters with foreign subsidiaries (M). The share of each firm type in all types is shown in parentheses. Asymptotic p-values are shown in square parentheses.

without foreign subsidiary over the entire productivity distributions.

From the results of Tables 7 and 8, using transitivity, I can also conclude that the productivity distribution of exporters with foreign subsidiaries stochastically dominates that of non-exporters. To summarize, I can conclude that (i) the productivity distribution of exporters with foreign subsidiaries stochastically dominates that of exporters without foreign subsidiary and that (ii) the productivity distribution of exporters without foreign subsidiary stochastically dominates that of non-exporters. These results are consistent with the theoretical conjectures that exporters with foreign subsidiaries are the most productive and that exporters without foreign subsidiaries are more productive than non-exporters.

6 Conclusions

This study examines the relationship between firm productivity and exports in

the wholesale sector. I predict that exporters are more productive than non-exporters in the wholesale sector, as in Melitz (2001). I also predict that exporters with foreign subsidiaries are more productive than exporters without foreign subsidiary since more productive firms find it profitable to pay the fixed costs of FDI and enjoy lower variable trade costs. Using the non-parametric KS tests, this study provides the first evidence that the productivity distribution of exporters with foreign subsidiaries stochastically dominates that of exporters without foreign subsidiary and that the productivity distribution of exporters without foreign subsidiary stochastically dominates that of non-exporters. These results are consistent with the above theoretical conjectures.

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Appendix 1: CDF of productivity, and the KS test statistics for manufacturing

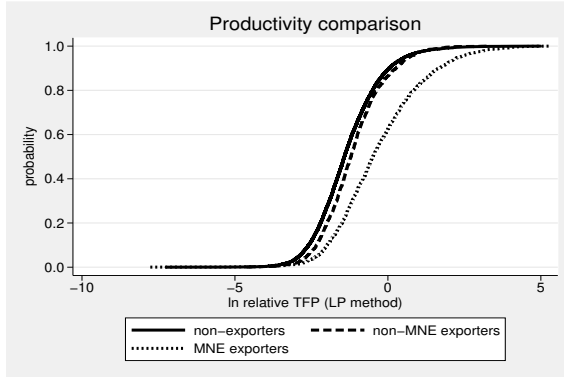


Figure 2: Export status and CDF of productivity in the manufacturing sector (2008)

Table 9: Kolmogorov-Smirnov tests statistics for the manufacturing sector:
Non-exporters vs. Exporters without foreign subsidiary

Year	N. of firms		Statistics	
	D	X	Two-sided H_0 : equality	One-sided H_0 : $D < X$
2001	9,591 (71.2)	1,898 (14.1)	0.092 [0.000]	-0.004 [0.956]
2002	9,233 (70.2)	1,885 (14.3)	0.075 [0.000]	-0.003 [0.966]
2003	8,795 (69.5)	1,799 (14.2)	0.077 [0.000]	-0.003 [0.964]
2004	9,283 (68.9)	1,921 (14.3)	0.078 [0.000]	-0.002 [0.982]
2005	9,020 (68.3)	1,873 (14.2)	0.091 [0.000]	-0.003 [0.974]
2006	8,828 (68.1)	1,877 (14.5)	0.084 [0.000]	-0.002 [0.992]
2007	9,247 (68.1)	1,943 (14.3)	0.085 [0.000]	-0.004 [0.947]
2008	9,266 (68.0)	1,922 (14.1)	0.097 [0.000]	-0.005 [0.933]

Notes: Kolmogorov-Smirnov tests for non-exporters (D) vs. exporters without foreign subsidiary (X). The share of each firm type in all types is shown in parentheses. Asymptotic p-values are shown in square parentheses.

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Table 10: Kolmogorov-Smirnov tests statistics for the manufacturing sector:
Exporters without foreign subsidiary vs. exporters with foreign subsidiaries

Year	N. of firms		Statistics	
	X	M	Two-sided H_0 : equality	One-sided H_0 : $X < M$
2001	1,898	1,981	0.317	-0.001
	(14.1)	(14.7)	[0.000]	[1.000]
2002	1,885	2,040	0.323	-0.001
	(14.3)	(15.5)	[0.000]	[0.996]
2003	1,799	2,066	0.330	0.000
	(14.2)	(16.3)	[0.000]	[1.000]
2004	1,921	2,268	0.297	0.000
	(14.3)	(16.8)	[0.000]	[1.000]
2005	1,873	2,314	0.283	0.000
	(14.2)	(17.5)	[0.000]	[1.000]
2006	1,877	2,267	0.281	-0.001
	(14.5)	(17.5)	[0.000]	[0.995]
2007	1,943	2,383	0.280	-0.001
	(14.3)	(17.6)	[0.000]	[0.997]
2008	1,922	2,436	0.275	-0.003
	(14.1)	(17.9)	[0.000]	[0.980]

Notes: Kolmogorov-Smirnov tests for exporters without foreign subsidiary (X) vs. exporters with foreign subsidiaries (M). The share of each firm type in all types is shown in parentheses. Asymptotic p-values are shown in square parentheses.